To: Wetland Recovery Project Board of Governors

From: Science Advisory Panel

Date: May 2, 2001

Re: Progress report on SAP Activities

Summary of Recommended Actions

- Approve addition of Drs. Eric Stein and Michael Horn to the Science Advisory Panel

At its last meeting, the Wetlands Recovery Project (WRP) Governing Board approved the Science Advisory Panel's (SAP) plan to focus on two items during the next year:

1. Develop a position paper that extends the generic program goals proposed during the WRP Symposium 2000 to specific, scientifically-based objectives that can be used to guide the acquisition and restoration program. As part of this process, the SAP will identify data gaps and facilitate the development of the data infrastructure necessary to refine the regional goals and support their implementation.

2. Develop an extramurally-funded research program to address the role of coastal wetlands in nearshore public health issues. Concerns about the relationship between coastal wetlands and public health could significantly impact the WRP's ability to pursue restoration projects. A critical first step for addressing this issue is to summarize the current understanding of the relationship between coastal wetlands and public health, and to identify topics for which additional research is needed.

This memo outlines the progress that has been made toward accomplishing these tasks and details additional activities that the SAP has undertaken since the last Governing Board meeting.

1. Position Paper on WRP Regional Goals and Objectives

At their March 28, 2001 meeting, the SAP reviewed the draft goals chapter of the WRP Regional Plan that was prepared by the manager's group following the October 2000 Symposium. The SAP identified that two of the draft goals required a scientific basis for implementation. These are: Goal 2 (Improve ecosystem functions and water quality in coastal watersheds and associated wetlands, and Goal 3 (Recover habitat and species diversity). The SAP further identified that the remaining goals, as proposed at that time, were primarily programmatic and did not require SAP attention.[1]

[1] Note that in subsequent drafts of the goals chapter of the WRP Regional Plan, Goal 2 has been modified to read "Preserve and restore stream corridors in coastal watersheds." Discussions of restoration of ecosystem functions (including water quality) have been incorporated into the need statements and key strategies in Goals 1 and 2 of the WRP Regional Plan.

The SAP discussed two possible paradigms to refine Goal 3 (species and habitat diversity): 1) a species approach, in which restoration decisions are based on providing optimal habitat for individual species (i.e. dominant, threatened or endangered species), or 2) a habitat approach, in which the objective is to restore habitat diversity with the presumption that high species diversity would be an expected outcome of the appropriate mix of wetland habitats in Southern California. The SAP selected the habitat approach with the idea that the restoration needs in southern California were so extensive that they transcended management of individual species. They acknowledged, however, that species-specific management may still take place at the level of individual projects as they arise.

The SAP next outlined a strategy to make the habitat paradigm more measurable. Their proposed approach consists of establishing wetland habitat categories and trying to mimic the historic ratio of acreage and patch size among these habitat categories. While historical coastal wetland acreage by habitat type has been mapped for some parts of southern California, additional work is required for a more accurate picture of historical conditions. The SAP will work with the Managers Group to establish wetland habitat categories, compile existing data, produce historical and present-day habitat maps, and identify funding sources to complete this database.

Due to the lack of time, discussion of Goal 2 (ecosystem function and water quality), was limited to outlining the ecosystem functions to consider (i.e. water quality, habitat quality, hydrology, etc.) At the next SAP meeting, the group will continue to outline more specific indicators of ecosystem function.

2. Research Program to Address Issues of Concern to the WRP

The SAP discussed how to structure the request for proposals. They decided the most efficient mechanism to administer the research program would be through the Sea Grant System. The group also decided that of the $500K requested for this program, $400K should be allocated for 2 to 4 large grants, and the remaining $100K should be allocated to fund graduate student research projects. The purpose of targeting graduate student research for support is to increase the number of scientists with experience in Southern California wetland ecosystems. The panel tabled further planning of the RFP pending allocation of $500K.

Other SAP Activities

1. Half-time Support Staff for SAP

The Governing Board allocated funding for a half-time staff person to assist the SAP in carrying out its multi-year agenda. On March 26, 2001, Dr. Martha Sutula was hired for this position (see attached resume). Dr. Sutula has a Masters degree in Public Health and a Ph.D. in Aquatic Ecology, specializing in nutrient cycling in coastal wetlands ecosystems. Her dissertation research at Louisiana State University focused on the effect of hydrological restoration on Southern Everglades wetlands nutrient cycling and exchange with Florida Bay. As a post-doctoral research associate at Tulane University, she conducted research in the Mississippi River

to understand how seasonal hydrological forcing of the river controls the bio-availability of phosphorus exported to the Gulf of Mexico.

2. Developing Analytical Tools to Guide WRP Acquisition/Restoration Projects

The SAP has identified the need to provide the WRP with an analytical framework to translate regional goals into specific acquisition and restoration guidance. The SAP is currently exploring the possibility of adapting the NOAA Spatial Wetland Assessment for Management and Planning (SWAMP) model for this purpose in Southern California. Lori Sutter of the NOAA Coastal Services Center in Charleston, SC presented the SWAMP model to the group. This is a conceptual GIS model to evaluate the relative significance of tidal and riverine/riparian wetlands by evaluating a wetland's contribution to habitat, water quality, and hydrology within the watershed. The SAP felt that WRP could use this model to prioritize its acquisition and/or restoration efforts by the relative importance of a wetland in the landscape. NOAA has tentatively committed funding for technical assistance in adapting this model for use in Southern California. The SAP asked that NOAA present the SWAMP model to the Managers group at their July 11, 2001 meeting. Should the Managers' group endorse application of the SWAMP model, the SAP will draw up a scope of work, identify data needed to develop the model, and look for sources of funding to undertake this activity.

3. Nomination of New SAP Members

In order to carry out its agenda, the SAP discussed and outlined two areas of technical expertise for which new SAP members will be needed: watershed ecology and coastal wetland food web dynamics. We identified two potential candidates and requested that the Managers Group nominate them: Drs. Eric Stein (PCR Services Corporation) and Michael Horn (Cal State-Fullerton). The Managers Group reviewed their qualifications and joins the SAP in recommended that Drs. Stein and Horn be added to the SAP (see attached resumes).

4. Future Activities

The SAP discussed its meeting schedule. Decided on three meetings per year, with one of those being a two-day meeting. The SAP then proceeded to schedule and plan the agenda for the next two meetings:

- July 2001: A two-day meeting to continue development of the habitat diversity and ecosystem function goals. This meeting will also be used to further define the scope of activities and data needs to support the SWAMP modeling process, should the model be endorsed by the Manager‘s group.

- September 2001: A one-day meeting to outline a strategy for a WRP monitoring program. Development of a monitoring program is a logical extension of the goal development process, as monitoring should help quantify progress towards achieving goals. This meeting will explore partnerships with other organizations interested in monitoring Southern California wetlands, with invitations having been issued to EPA's Environmental Monitoring and Assessment Program and to UC-Davis, which recently received an EPA grant to develop

wetlands indicators. The SAP anticipates that these potential partnerships will leverage WRP funds and enhance the quality of the WRP regional monitoring program.

Curriculum Vitae

Martha A. Sutula, Ph.D

EDUCATION:

Ph.D., Coastal Ecology, Louisiana State University, 1999
M.S., Public Health, Tulane Univ. School of Public Health & Tropical Medicine, 1994
B.S. Chemistry, Purdue University

AREAS OF EXPERTISE:

Dr. Sutula is an aquatic ecologist specializing the biogeochemistry of coastal ecosystems. Her dissertation research at Louisiana State University focused on effect of hydrological restoration on Southern Everglades wetlands biogeochemistry and exchange with Florida Bay. This included constructing hydrological and nutrient budgets of Southern Everglades watershed, quantifying nutrient flux from Southern Everglades wetlands to Florida Bay, and developing a computer simulation model to explore the effects of hydrological restoration on nutrient cycling in mangrove wetlands. As a post-doctoral research associate at the Tulane University Institute for Earth and Ecosystem Science, she conducted research in the Mississippi River and Gulf of Mexico to understand how seasonal hydrological forcing of the river controls the bio-availability of particulate and sedimentary phosphorus exported to the Gulf of Mexico. Dr. Sutula has also participated in the monitoring and assessment of the impact of municipal secondarily-treated wastewater on Louisiana coastal wetland productivity and water quality, and developed an internet guide for the use of Louisiana coastal wetlands as bio-filters for municipal wastewater.

PROFESSIONAL EXPERIENCE:

Wetlands and Watershed Ecologist, Southern California Coastal Water Research Project. Westminster, California, 2001 - present

Post-doctoral Research Associate, Tulane University Institute of Earth and Ecosystem Sciences, New Orleans, Louisiana, 1999 - 2001

Research Assistant, Louisiana State University Department of Oceanography and Coastal Sciences, Baton Rouge, Louisiana, 1995 - 1999

Research Assistant, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana, 1993 - 1994

Project Manager, U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Risk Management Division, Washington DC, 1991 – 1993

Aquaculture Extension Agent, U.S. Peace Corps, Bandundu, Zaire, 1987-1991

HONORS, AWARDS, AND PROFESSIONAL MEMBERSHIPS:

- Sigma Xi Scientific Honor Society member 1999
- Gulf Estuarine Research Society Conference-Best Student Paper Award 1998
- Chancellor's Fellowship for Doctoral Studies, Louisiana State Univ., 1995.
- Phi Beta Kappa member 1986.
- Chemical Industrial Society of Illinois Scholarship 1986 (for outstanding Junior in Chemistry)
- Vice-President, Marine Environmental Researchers, LSU, May 1996 - 1997
- Member, Estuarine Research Federation
- Member, American Society of Limnology and Oceanography

PUBLICATIONS

Sutula M., Day, J., and Cable, J. In press. Constraining the hydrological and nutrient budgets of Southeastern Everglades wetlands. *Biogeochemistry*

Sutula M., Perez B., Reyes E., Day J.W., Jr., and Childers, D. In review. Spatio-temporal variability in material exchange between the Southeastern Everglades Wetlands and Florida Bay, *Estuarine, Coastal, and Shelf Science*

Sutula M., Reyes E., and Day J.W., Jr. In prep. Modeling nutrient cycling in the surface waters of the southern Everglades mangrove wetlands *Ecological Modelling*.

Sutula M., Bianchi T. and McKee B. In prep. Effect of seasonal sediment storage and diagenesis in the lower Mississippi River on bio-availability of particulate phosphorus flux to Gulf of Mexico. *Limnology and Oceanography*

Sutula M., Bianchi T. and McKee B. In prep. Lower Mississippi River seasonal sediment storage, diagenesis, and remobilization: Implications for water column nutrient cycling in the Mississippi River and export to the Louisiana Shelf. *Estuaries*

Sutula M. and Day J.W., Jr. 1994 Exploring the Use of Wetlands for Wastewater Treatment: A Guide for Municipalities and Businesses. Internet Publication (http: //www.lsu.edu/guests/wwwcei/ wastewaterguide/I.html).

SELECTED EXTENDED ABSTRACTS

Sutula et al. 2001 Effect of seasonal hydrological forcing in the Mississippi River on the bio-availability of phosphorus exported to the Gulf of Mexico, American Society of Limnology and Oceanography, Albuquerque, New Mexico Feb 2001.

Sutula et al. 1999 The Energy Signature of the Southern Everglades and its Control on Nutrient Transport to Florida Bay. Tulane University Institute of Earth and Ecosystem Sciences. March 2000 (Invited Lecture).

Sutula et al., 1999. Processes controlling nutrient transport in the Southeastern Everglades Wetlands and Exchange with Florida Bay. Estuarine Research Federation Conference, New Orleans, Louisiana Sept 1999.

Sutula et al., 1999. Hydrological restoration of the southern everglades and its effects on freshwater marsh and estuarine nutrient budgets. American Society of Limnology and Oceanography, Santa Fe, NM. Feb 1999.

Sutula et al., 1998 Spatio-temporal variability in material concentration and transport in Southern Everglades Wetlands. American Society of Limnology and Oceanography/ Ecological Society of America Joint Meeting. June 1998.

Sutula, et al., 1998 Annual nutrient exchange between NE Florida Bay and a mangrove creek in the southern Everglades. Gulf Estuarine Research Society Spring Meeting 1998, Galveston, TX (USA), 26-28 Mar 1998

ABRREVIATED CURRICULUM VITAE

Michael H. Horn

April 2001

Address

Department of Biological Science
California State University
Fullerton CA 92834-6850 USA
Phone (714) 278-3707/3614
Fax (714) 278-3426
Email mhorn@fullerton.edu

Employment

California State Univ, Fullerton
Assistant Professor, 1970-1973
Associate Professor, 1973-1977
Professor, 1977-present
Social Security No.445-46-1689

Degrees

B.S. Biology Northeastern State University (1963)
M.S. Zoology University of Oklahoma (1965)
Ph.D. Biology Harvard University (1969)

Other Positions and Visitations

Postdoctoral Fellow	Woods Hole Oceanographic Institution (1969)
Postdoctoral Fellow	British Museum (Natural History), London (1970)
Visiting Scientist	Southwest Fisheries Science Center, La Jolla (1971)
Visiting Scientist	Queen Mary College, University of London (1974)
Visiting Scientist	Dunstaffnage Marine Laboratory, Scotland (1986)
Visiting Scientist	La Selva Biological Station, Costa Rica (1989, 1992, 1993, 1998, 2000)
Visiting Scientist	Pontificia Universidad Catolica de Chile, Santiago (1996)
Visiting Scientist	Austevoll Aquaculture Research Station, Norway (1998)
Visiting Scientist	Estación de Campo del Golfo de Santa Clara, Mexico (1999)

Courses Taught

Biogeography, Conservation Biology, Ecology of American Indians, Ichthyology, Marine Biology, Principles of Ecology, Principles of Zoology, Professional Aspects of Biology, Seminars in Ecology, Seminars in Marine Science

Academic Awards and Honors

Outstanding Professor Award, California State Univ, Fullerton CSUF (1980)
Alumni Distinguished Faculty Award, CSUF (1980)
Exceptional Merit Service Award, CSUF (1984)
Meritorious Performance and Professional Promise Award, CSUF (1985, 1987, 1989)
Lynne K. McVeigh Award for Exceptional Service to Students, College of Natural Sciences and Mathematics, CSUF (1990)
A. James Diefenderfer Dean's Award for Outstanding Contributions to Students, College of Natural Sciences and Mathematics, CSUF (1991)
Dean's Award for Outstanding Research, College of Natural Sciences and Mathematics, CSUF (1998)
Outstanding Faculty Recognition: Scholarly & Creative Activity, CSUF (1998, 2001)

Honorary Member, Golden Key National Honor Society (1984 -)

Administrative Position

Graduate Program Adviser, Department of Biological Science, California State University, Fullerton (1984-)

Professional Societies

American Association for the Advancement of Science
American Fisheries Society (Member, Award of Excellence Committee, 1986-1987)
American Indian Science and Engineering Society
American Institute of Biological Sciences
American Ornithological Union
American Society of Ichthyologists and Herpetologists (Ichthyology Book Review Editor, 1985-1992; Board of Governors, 1995-1999; Editorial Board, 1985-1992, 1994-1995)
Association of American Indian and Alaskan Natives Professors
California Native Plant Society
Comparative Nutrition Society
Cooper Ornithological Society
Desert Fishes Council
Ecological Society of America
Estuarine Research Federation
Pacific Seabird Group
Society for Conservation Biology
Society for Integrative and Comparative Biology (Member, Public Affairs Committee, 1984-1986)
Society for the Advancement of Chicanos and Native Americans in Science
Society of the Sigma Xi
Southern California Academy of Sciences (Member, Board of Directors, 1982-1987)
Southern California Botanists
Waterbird Society
Western Society of Naturalists (President, 1994)
World Conservation Union (Member, Education Commission, 1982-1991)

Refereeing Activities

Proposals for National Science Foundation and National Sea Grant Program, manuscripts for various journals and publishers

Editing Activities

Editorial Board, Progress in Fish Research (2000-); Regional Editor, Marine Biology, (1998-2000); Editorial Board, Copeia (1994-1995)

Supervision of Graduate Student Research

Thesis adviser for 29 students receiving the M.A./M.S. degree; thesis committee member for 55 others receiving the M.A./M.S., for five receiving the Ph.D.

Research Interests

Feeding ecology and digestive physiology of herbivorous fishes

Feeding ecology and digestive physiology of fish-eating seabirds
Molecular and morphological variation in coastal fish populations
Seed dispersal by fruit-eating fish in tropical rain forests
Long-term ecological changes in fish and seabird communities
Landscape-scale conservation biology

Cumulative Amounts and Sources of Extramural Research Support

Grants ($1,408,792)

American Philosophical Society (1972-1976, 1980-1982)
National Geographic Society (1986)
National Institutes of Health (MSD Program participant, 1998-2001)
National Science Foundation (1978-1985, 1988-1993, 2000-2002)
National Sea Grant Office (1990, 1996-2001)
Orange County Fish & Game Commission (1978-1979)
Sea and Sage Audubon Society (1992, 1993)
Sigma Xi (1973-1974)
U. S. Fish & Wildlife Service (1995-1996, 1997-2000)

Contracts ($108,883)

Bureau of Land Management (1973-1974)
California Department of Fish & Game (1978,1991)
Ports of Long Beach and Los Angeles (1977, 1979-1983)
U. S. Fish & Wildlife Service (1980-1981, 1994-1995)
University of California, Davis (1991)

Current Extramural Grants

National Science Foundation, Undergraduate Mentoring in Environmental Biology
$400,000 (2001-2005) (co-principal investigator with seven other faculty; amount not included in extramural grant dollars listed above)
Ecology and environmental biology of changing southern California ecosystems

National Science Foundation, Biological Oceanography Program
$450,019 (2000-2002)
Digestive specializations for herbivory in marine fishes: Genetic adaptation and phenotypic plasticity in gut structure and function in a clade of prickleback fishes

National Institutes of Health, CSUF Minority Scientist Development Program
$36,268 (1998-2001)(one of several principal investigators)
Comparative ultrastructure of the intestinal epithelium of three related silverside fishes (Family Atherinopsidae) with different diets
(Chad Freeman, MSD student)

National Sea Grant Office, University of Southern California Program
$156,019 (1996-2001)
Food web structure and heavy metal accumulation in a recently established guild of breeding seabirds in southern California
(Charles T. Collins and Andrew Z. Mason, California State University, Long Beach, co-Principal Investigators)

ERIC D. STEIN, DR.ENV.

ABBREVIATED CURRICULUM VITAE

SUMMARY OF QUALIFICATIONS

Dr. Eric Stein has extensive experience in research, environmental policy, regulation, planning; and expertise in a diversity of scientific fields. Dr. Stein has been engaged in research activities for the past 17 years including intestinal nutrient transport kinetics, physiological ecology, multimedia distribution of environmental contaminants, human health risk and exposure assessment, and most recently landscape ecology, cumulative impact assessment, and spatial analysis of wetland impacts. Skilled in all aspects of research design, implementation, analysis, and presentation. Eight years experience in wetlands regulation, including permitting, wetland delineation, design of mitigation and restoration projects, establishment of mitigation banks, policy development, watershed planning, and wetland functional assessment. Experience in project management, writing scopes of work, developing budgets, and managing staff resources. Excellent written and oral communication skills. Published more than ten peer-reviewed articles, numerous Public Notices and Environmental Assessments, and has participated in management of Environmental Impact Statements. Has presented research findings at fifteen professional conferences and symposia. Taught high school biology for three years and currently is an associate adjunct professor at California State University, Los Angeles, teaching classes related to environmental assessment and watershed planning.

PROFESSIONAL EXPERIENCE

Principal Ecologist (PCR Associate Principal), Regulatory Specialist - *PCR Services Corporation*, 1998-Present

Function as manager of the Wetlands Services Group and as an independent project manager overseeing multiple concurrent projects and a staff of ten biologists. Responsible for a broad range of analytical, technical, and administrative tasks.

Project management responsibilities include serving as the technical expert on projects, overseeing and managing interdisciplinary staff, reviewing and editing reports, administering contracts and subcontracts, budgeting, and managing staff assignments. Sample projects include regional conservation planning, quantitative functional assessment and ecosystem modeling, large and small scale wetland delineations, design of wetland restoration programs, and processing of state and federal wetland permits. As a project manager, I am ultimately answerable to the client for the quality and timeliness of the promised product or service.

Administrative and programmatic responsibilities included developing new business opportunities, overseeing daily operation of Biological Services Division, cultivating client relationships, soliciting and preparing proposals, scopes of work, and budgets. Responsible for overall scheduling, mentoring, and managing a staff of ten scientists. Work with the Division Director on setting mid and long term goals and directions for the Biological Services Group, developing annual business plans, and selecting new employees.

Effective performance of duties requires excellent written and oral communication skills, strong organizational skills, and ability to maintain ongoing interactions and relationships with staff, clients, and agency representatives.

Adjunct Associate Professor - *California State University, Los Angeles, Department of Geography and Urban Analysis.* 1998 to Present.

Designed and taught an upper division undergraduate course , entitled "Environmental Assessment" and a graduate seminar, entitled "Conservation Planning".

Environmental Assessment covered the legal and economic factors aspects of environmental assessment, and the basic science and policy factors associated with the assessment of impacts to the biological and physical environment. Topics included assessment of impacts to air quality, water quality, surface hydrology, groundwater, soil, biotic systems, multimedia distribution of pollutants, ecological and human health risk assessment, cumulative impacts, landscape level and spatial analysis of impacts, and ecosystem/watershed planning.

Conservation Planning covered the political, social, and scientific aspects of conservation planning. Topics included the political, economic, and social factors associated with establishing regional conservation plans, an overview of the major physical and biological processes that control biodiversity and the viability of natural resources, and strategies for designing and implementing a regional conservation plan.

Both courses were special topics course which were designed to assist in the Geography Department's development of an environmental studies track..

Biologist, Senior Project Manager - *U.S. Army Corps of Engineers, Los Angeles District, Regulatory Branch.* 1993 to 1998.

Evaluated permit applications pursuant to Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, and Section 103 of the Marine Research Protection and Sanctuaries Act. Conducted compliance inspections and pursue enforcement actions as necessary.

Prepared Environmental Assessments and participate in management of Environmental Impact Statements pursuant to the National Environmental Policy Act, reviewed and commented on Environmental Impact Reports pursuant to the California Environmental Quality Act. Coordinated with state and federal agencies in order to ensure compliance with all applicable laws, including the Endangered Species Act, National Historic Preservation Act, and Coastal Zone Management Act.

Performed wetland delineations, jurisdictional determinations, and functional assessments. Provided guidance in the development of mitigation plans and regional mitigation banks. Worked with state and local agencies on watershed planning efforts.

Performed research on functional assessment of aquatic ecosystems, cumulative impact assessment, and spatial impact analysis. Worked with interagency teams on the development of the hydrogeomorphic assessment for riparian wetlands and for vernal pools of the southwestern U.S., regional watershed planning and assessment protocols, and on the development of several mitigation banks.

Duties required good oral and written communication including preparing public notices and correspondences, participating in public and agency meetings, answering questions from the general public, and mediating differences between divergent interests.

Graduate Researcher - *UCLA Environmental Science and Engineering Program.* 1991 to 1993.

Conducted research with Arthur Winer and Yoram Cohen on the environmental distribution of toxic air contaminants and the associated exposure and health risks. Project required critical review of all pertinent literature; compilation of best available data on source strength, physicochemical properties, and intermedia transfer factors; and computer modeling of multimedia distribution and exposure to air toxics. Prepared comprehensive documents for the California Air Resources Board summarizing conclusions of the research.

Teacher - *Alhambra High School, Alhambra City School District.* 1988 to 1991.

Taught 10th grade College Preparatory Biology and 10th - 12th grade Life Science, including all lab sections. Faculty advisor for the campus Environmental Sciences Program.

Educational Technology Consultant - *IBM Educational Instruction Division*. 1988 to 1993.

Designed and taught workshops for teachers on integrating computer technology into secondary math and science curriculum. Prepared and presented marketing demonstrations for school districts and professional conferences.

Research Associate - *UCLA Department of Physiology*. 1984 to 1991.

Conducted research with Jared Diamond on the relationship between dietary constraints and nutrient transport across intestinal brush border membranes. Responsible for all aspects of research including study design, collection of field specimens and laboratory data, data analysis and interpretation, and publication and presentation of results. Experience in laboratory analytical methods, statistical analysis, and spreadsheet and graphics programs.

EDUCATION

Doctor of Environmental Science and Engineering (D.Env.), University of California, Los Angeles 1995. Dissertation Title: *Assessment of the Cumulative Impacts of Section 404 Clean Water Act Permitting on the Ecology of the Santa Margarita, CA Watershed*.

Masters of Education (M.Ed.) in Secondary Level Instruction, University of California, Los Angeles 1988.

California State Teaching Credential in Biological Sciences, Single Subject Professional Clear Credential 1988.

Bachelor of Science (B.S.) in Biology, University of California, Los Angeles 1987.

SPECIAL TRAINING

- Wetland Identification and Delineation, *Corps of Engineers & Natural Resources Conservation Service*
- Wetlands Functions and Values, *Corps of Engineers*
- Special Issue Areas of the Corps Regulatory Program, *Corps of Engineers*
- Application of NEPA and Preparation of EIS/EAs, *Corps of Engineers*
- The Inland Testing Manual for Evaluation of Dredged Material Disposal in Waters of the U.S., *USEPA*
- Hydrogeomorphic Approach to Wetland Assessment, *National Wetland Science Training Cooperative*
- Hydric Soils for Wetland Delineation, *Natural Resources Conservation Service*
- WordPerfect 6.1 Advanced Training, *ExecuTrain*

REFERENCES

Dr. Mark Sudol
U.S. Army Corps of Engineers
Los Angeles District, Regulatory Branch
911 Wilshire Blvd.
Los Angeles, CA 90017
(213) 452-3406

Dr. Richard Ambrose
Environmental Science and Engineering Program
UCLA School of Public Health
10833 Le Conte Ave.
Los Angeles, CA 90095
(310) 825-6144

Dr. Jared Diamond
Department of Physiology
UCLA School of Medicine
Los Angeles, CA 90095
(310) 825-6177

Dr. Arthur Winer
Environmental Science and Engineering Program
UCLA School of Public Health
10833 Le Conte Ave.
Los Angeles, CA 90095
(310) 206-1278